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Dairy Div.

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UNITED STATES DEPARTMENT OF AGRICULTURE

HAY STACKERS

HOW THEY MAY BE USED IN
THE EAST AND SOUTH TO
SAVE LABOR



THE HAY STACKER is to stacking what the horse-fork is to putting hay in the barn, a saver of man labor.

It enables the farmer to lift the hay on to the stack by horse power instead of man power.

The stacker is used almost universally in the West, where stacking is the usual method of storing hay.

In the East and South, where much of the hay grown is stored under cover, the stacker could be used to advantage when it becomes necessary to stack, especially where labor is scarce.

Where the stacker is used, a boy or woman, driving the team that hoists the hay, can take the place of a man in the haying operation.

Stackers are comparatively inexpensive; there are several serviceable types which may be cheaply made at home.

Office of the Secretary

Contribution from the Office of Farm Management

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HAY STACKERS.

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POSSIBILITIES OF HAY STACKERS IN THE EAST AND SOUTH.

HAY STACKERS can be used to advantage on many farms east of the Mississippi River as well as west. They are especially useful at times when farm labor is scarce, as they enable the farmer to handle hay more rapidly than by other methods, and in many instances a smaller number of men will be required. When the hay is loaded on the wagon by hand, and unloaded with a stacker, one-half of the hand labor is eliminated. If push rakes or hay loaders are used in connection with the stacker, pitching by hand is entirely avoided.



FIG. 1.—Loading the wagon by hand. Less hay is handled per man per day than by any other method. This method necessitates the use of men only, while other and better methods allow boys to replace men for some of the operations.

WHY STACKERS ARE NOT IN GENERAL USE IN THE EAST.

Many Eastern farmers are cautious about spending money for something entirely untried. A few have tried stackers but have abandoned them, owing partly to inexperience and partly to difficulty in getting their men to give them a fair trial. Some of the stackers purchased were cheaply constructed and of a type not suited to conditions. Other farmers have not attempted to use stackers because they have been in the habit of making small stacks containing from 1½ to 3 tons, and think that hay will not keep in a large stack such as is made with a stacker—an objection not based on facts.

Putting hay into the barn is preferable to stacking. When hay is stacked for any considerable time more or less loss occurs through exposure to sun and rain unless the stack is covered. In many sections hay barns would soon pay for themselves. Yet many farmers will continue to stack part or all of their hay until they become convinced that hay barns or sheds are a good investment. This bulletin, therefore, describes the different types of stackers in use, states the conditions favorable for each type, and points out the saving of man labor made possible by the use of the stacker.

DESCRIPTIONS OF HAY STACKERS.

Hay stackers in use may be divided into two general types according to the way they handle the hay. One type has teeth on which it receives hay brought to it by push rakes, and the other handles the hay by means of the harpoon fork, grapple fork, or sling.

The first type is represented chiefly by the "overshot" and the "swing-around" stacker. Each of these has long wooden teeth, like those of a push rake. The push rake drops its load of hay directly on these teeth. When the push rake is operated properly, there is no necessity for hand work, except that occasionally it may be necessary to gather up scattered hay with a fork when several push rakes are used. Two horses are used to elevate the hay to the proper height to be dropped on the stack.

The second type, stackers that do not receive hay directly from push rakes, but handle it by means of horse forks or slings, are usually classed as homemade stacking outfits, since the material used for their construction is usually assembled on the farm.

THE OVERSHOT STACKER.

The overshot stacker (fig. 2) is so called because the hay is carried up and over the stacker frame and delivered at one point on the stack. This necessitates considerable moving of hay by hand when the stack is large. The overshot stacker is simple in construction, efficient in operation, inexpensive, both in first cost and in upkeep,

and is sometimes homemade, especially in the West, where haying is done on a large scale. Nearly all stackers of this type are made of wood, and most of them are mounted on a heavy frame which serves as a sled to move the stacker from place to place. One kind of overshoot stacker is made with an inclined front, up which the head carrying the hay, mounted on small wheels, travels to the top, whence the hay is dumped on the stack.

Some makes of the overshoot type are mounted on wheels; often the running gears of a wagon are used (fig. 2). This feature prevents loss of time in moving the stacker, especially if the distance is considerable.

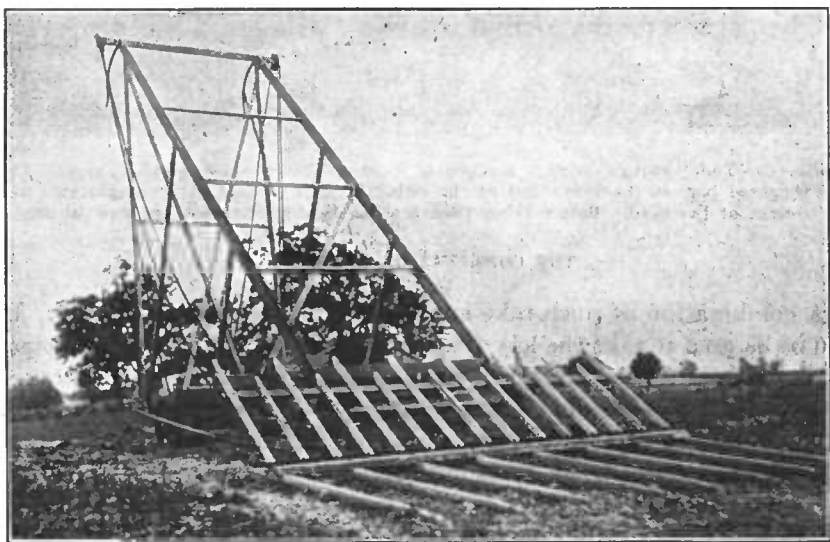


FIG. 2.—The "overshoot" stacker is in general use in the Middle West, and can be used for large or small stacks. This type is mounted on wheels, and very little time is lost by the crew when it is moved to a new stack site.

A device consisting of springs or weights that counterbalance the weight of the stacker head while the latter is returning to the ground after the hay has been dropped on the stack is a very desirable feature. Without it, the team must be backed slowly, holding the weight of the empty head until it reaches the ground. This causes loss of time and lessens the capacity of the stacker.

THE SWING-AROUND STACKER.

The principal advantage of the swing-around stacker over the overshoot type is its ability to deliver the load of hay to different parts of the stack, thus reducing the amount of work required on the stack (fig. 3.) The swing-around stacker can also be used to advantage in certain kinds of hay barns; when the hay is brought to the barn with push rakes.



FIG. 3.—The “swing-around” stacker is a very efficient and popular type. The weighted box on the lower end of the swinging arm is used to counterbalance the weight of the head. Better types than the one here represented are now in use.

THE COMBINATION STACKER.

A combination of push rake and stacker does the work of both. It can be used to take the hay from the windrow, swath, cock, or push rake, and place it on the stack in the same manner as does the over-shot stacker, but on any desired part of the stack. (See figs. 4, 5, and 6.) It can be used to advantage to load hay from the windrow or cock on wagons when labor is scarce, or when the distance is too

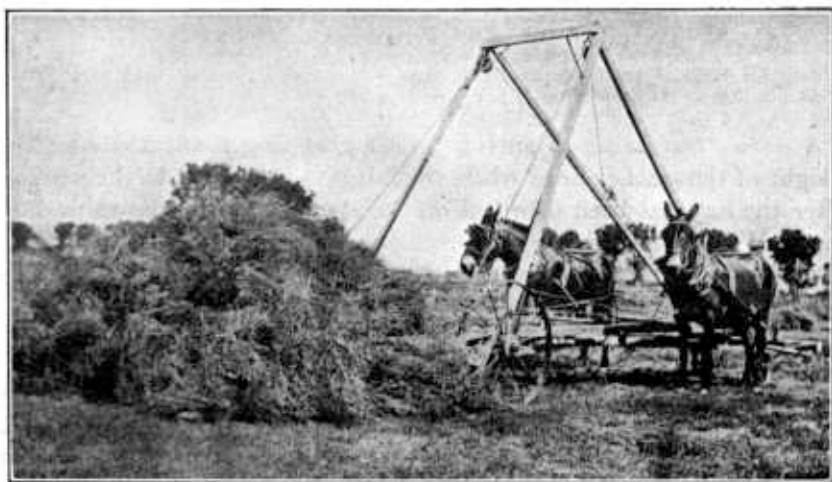


FIG. 4.—Combination stacker taking hay from windrow. The hay is taken directly from windrow to stack when labor is scarce and the distance hauled is short.

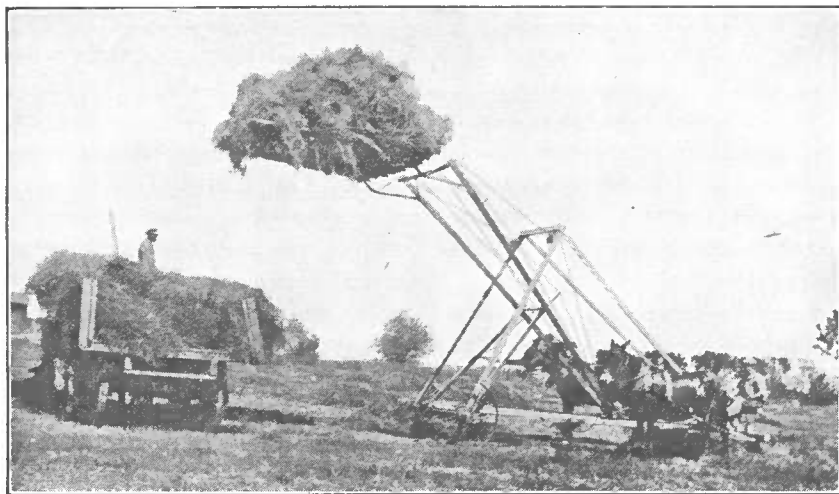


FIG. 5.—A combination stacker loading a wagon in the field. It takes the hay from the bunch or cock and as it is being moved forward a few feet the hay is elevated and dropped on to the wagon. It is not necessary to elevate the hay as high as is shown in the picture.

great to haul the hay with the stacker or the push rake. Its most common use, however, is at the stack, where it handles the hay brought in by push rakes. About half of the owners of this type of machine use it to take the hay directly from the push rake; the others take the hay from piles that have been dropped near the stack by the push rake.



FIG. 6.—The combination stacker putting hay on the stack. It can place the hay on the stack from either side or end, and the direction of the wind does not affect its usefulness in the least. Stacks a little more than 20 feet high can be made with this outfit.

THE CABLE STACKER.

The cable stacker is one of the simplest and most generally used homemade haying appliances. The A-shaped frames (fig. 7) usually are made from poles that can be obtained on the farm or nearby. The remainder of the material can be purchased ready for use from hardware dealers or mail-order houses. The material that must be bought for this outfit consists of 1 reversible cable carrier; 1 double harpoon fork, or grapple fork, or the required number of slings; 150 feet of half-inch galvanized steel cable, on which the carrier travels and which is used also for end guys; 2 cable clamps; 2 long bolts to bolt the tops of the poles together; 3 steel-yoke, knot-passing pulleys; 130 feet of three-quarter inch manila carrier rope,



FIG. 7.—Stacking hay with a cable stacker. This is a homemade outfit. The amount of hay damaged by the weather will be very small in a large, well-built stack like this.

and 65 feet of trip rope. The height of the stack which can be built with this outfit depends upon the length of the poles used. Poles 32 feet long will serve for most conditions.

POLE OR DERRICK STACKERS.

The single-pole or derrick stacker is used to a considerable extent in the Middle West and West. It consists of a single pole, long enough to make a stack of the desired height, to which is fastened a shorter pole (or boom) at right angles. (See figs. 8 and 9.) It is usually necessary to use three or four guy wires to make the top stable. Three pulleys, about 100 feet more or less of carrier rope, and a horse fork complete the outfit. Some are mounted on wheels (fig. 10), while others are mounted on a wooden platform having sled-like runners.



FIG. 8.—A simple, homemade pole stacker, capable of making a very tall stack. As the hay leaves the wagon the stacker turns and the hay is swung over the stack and dropped at the point desired. Stackers of this type must be held by heavy wire guys.

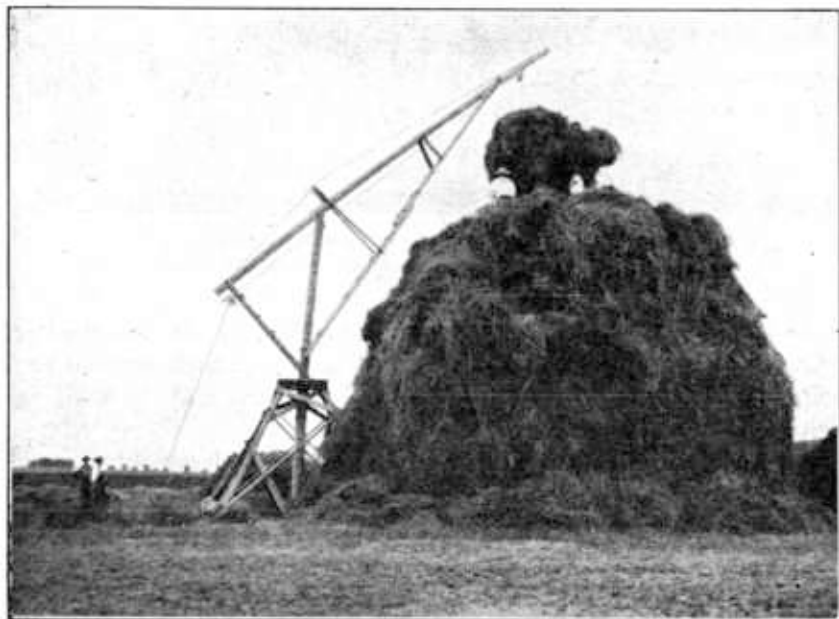


FIG. 9.—Homemade derrick stacker. This stacker is built on a heavy base made of poles. It is braced from below, which does away with the necessity of using guy wires such as are used in figure 8. This is a very poorly built stack. Stacks are sometimes built as loosely as this in the semi-arid West, but in the East or South the loss due to rain would be very great.

TRIPOD STACKERS.

The tripod stacker is the simplest and most easily made of all homemade stackers. Three poles about 30 feet long are bolted together at the top (fig. 11). The bottom is spread out far enough to permit a stack of the desired size to be built under the tripod. The equipment consists of three pulleys, a hay rope, a trip rope, and a horse fork. It is not necessary to use guy wires to hold the tripod stacker in place.

COST OF STACKERS.

Stackers are comparatively inexpensive. The most costly types, the overshot and the swing-around, may be bought for from \$45 to \$75, and homemade types may be made for a few dollars. If the

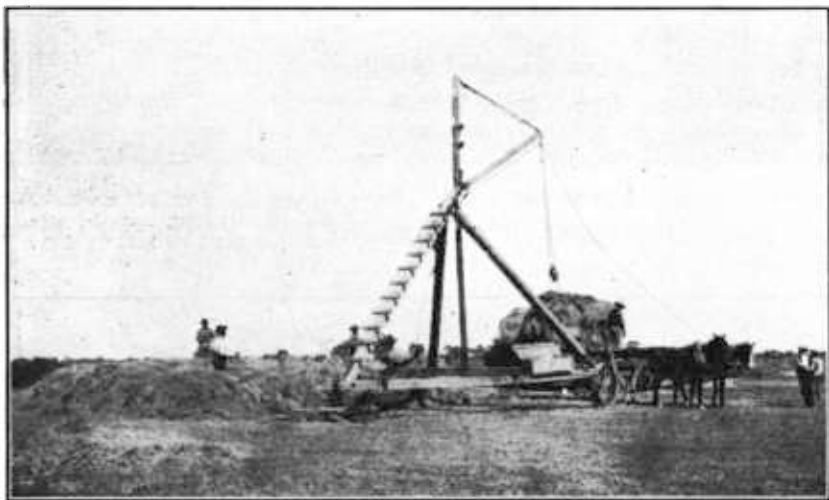


FIG. 10.—A large, heavily constructed, homemade derrick stacker mounted on wheels. This stacker can handle very large forkfuls of hay and can be moved quickly to a new stack site.

poles are cut on the farm, the homemade tripod or derrick stacker need not cost any more than an ordinary barn hay fork without the track. Indeed, the fork and rope from the barn may be used in rigging up such a stacker.

The cost of repairs, interest on investment, and replacement charges on stackers depend upon the amount of hay handled per year; the more hay handled per year the less the amount of these charges per ton. A stacker will last from 10 to 12 years under ordinary conditions. The charges for stackers on 27 farms in central Kansas, which stacked an average of only 144 tons of hay per year, amounted to less than 7 cents per ton when the yield was 1 ton per acre. The charges on 32 farms in central Nebraska, when twice this amount or 300 tons of hay were stacked per year, amounted to 3 cents per ton with a yield of 1 ton per acre.

SIZE AND MANAGEMENT OF STACKING CREWS.

The use of the stacker requires considerably less man labor than pitching the hay on the stack by hand, though it necessitates the use of more horses. The amount of hay stacked per man per day is greatly increased.

When the stacker is used, the composition of the crew is often changed advantageously. To get the hay on the stack, the cable stacker or the derrick stacker requires but one man to handle the horse fork or slings, and a boy, girl, or woman to drive the stacker horse or team. The overshot stacker and certain makes of swing-around stackers require merely a boy, girl, or woman to drive the stacker team. The cable and derrick types require one man less than

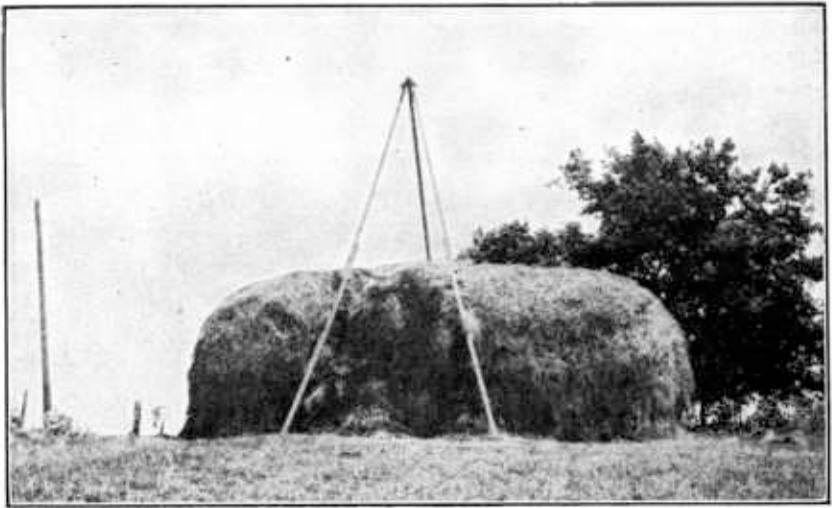


FIG. 11.—A tripod stacker which can easily be made on the farm. It is self-supporting and can be taken down and moved easily but not so quickly as those mounted on wheels. Stacks larger than this are seldom built by the small crew using a tripod stacker.

the number generally used when a small crew stacks by hand, and the overshot type does away entirely with the necessity of man labor in getting the hay on the stack. The combination push rake and stacker is operated by one man or boy and two horses, and when it is used fewer men are needed on the stack than when the overshot stacker is used, for the reason that this implement places the hay on any desired part of the stack.

LOADING AND UNLOADING BY HAND A SLOW METHOD.

On most farms in the East and South, hay that is stacked is pitched on wagons by hand and pitched by hand from the wagon to the stack. The 3-man crew, or some multiple of this unit, is used almost exclusively. With this crew two men pitch the hay on

the wagon to the third, who builds the load. When the load is on, all go to the stack, where two men pitch it to the third, who builds the stack. A 3-man crew stacking hay in the East will handle about the same amount of hay per day as when hauling and putting hay into the barn.

When hay is loaded by hand and unloaded with a horse fork or slings, the efficiency of a 3-man crew is increased from 30 to 50 per cent over the method of both loading and unloading by hand.¹ These figures apply to eastern conditions, where hayracks are used. On some farms in the South, hay is often hauled in wagon beds or on wood racks. In such cases the load often does not exceed 500 or 700 pounds and the amount of hay handled per man per day is much smaller than when hayracks are used. It is a waste of time and labor when such small loads as these are hauled.

The overshot, swing-around, and combination types of stackers are not adapted to unloading hay from the wagon, but all other types described are suitable for this purpose.

USING HAY LOADER AND STACKER A BETTER METHOD.

A hay loader and either the cable, derrick, or tripod stacker make a good combination for putting up hay, and one operating more efficiently than the first method described, since more hay can be handled per day by a small crew, and one man may be dispensed with. Two men and one boy constitute the loading, hauling, and stacking crew. The boy drives and the two men build the load on the wagon as it is delivered by the loader. At the stack, one man stays on the wagon to handle the horse fork or slings, as the case may be, one man works on the stack, and the boy drives the team hoisting the hay. When several wagons are used, the men who build the load remain in the field and a crew is kept working continuously at the stack, eliminating any loss of time in traveling to and from the stack.

The use of the loader and stacker will increase the efficiency of a small crew about 20 per cent over that of a crew loading with a loader and unloading by hand. Two men and a boy using a loader and stacker will handle about 75 per cent more hay per man per day than a 3-man crew loading and unloading by hand. To handle the greatest amount of hay possible, when using the loader, fairly large hayracks should be used. It is much easier and quicker to load a ton of hay on a long, wide rack, than on a short, narrow rack.

STACKING WITH PUSH RAKE AND HAND FORKS, AN INEFFICIENT METHOD.

A few farmers in the Middle West, whose acreage of hay is small, bring the hay to the stack with a push rake but pitch it on to the stack by hand. This practice is often found in certain parts of the

¹ United States Department of Agriculture Bulletin 412, *The Normal Day's Work of Farm Implements, Workmen, and Crews in Western New York.*

South where the growing of hay for the market is beginning to be a leading farm enterprise, and where the farm acreage in hay is much greater than that of the Middle Western farmer who does not use the stacker.

When stacking is done by hand and a push rake is used, the crew consists of four men and two horses. One man and a team operate the push rake all day and have no difficulty in bringing 12 or more tons to the stack. One man builds the stack, and each of the two pitchers pitches one-half the hay until the stack is about half made.

Up to this point the push rake is kept fairly busy, but now the entire crew's efficiency is reduced 50 per cent. A wagon with an empty hayrack is then placed at the side of the stack and one man pitches to the other pitcher, on the wagon, all the hay required to finish the stack; the man on the wagon in turn pitches it to the stack. The pitchers work just as hard as formerly, but they handle only half as much hay as before, and during this time the push rake is doing only half as much work as it did before the wagon and rack were brought into use.

On 15 farms where this method of stacking was used, one push rake brought, on an average, 12½ tons of hay per day from the cock to the stack. This amount of hay was often put into three or four small, round stacks, a practice entailing serious loss due to weather.

STACKING WITH PUSH RAKE AND STACKER, THE BEST WAY.

Stacking hay with push rake and stacker is by far the most efficient method. It requires fewer men to stack a given amount of hay per day than any other method, if the crew is organized properly.

The amount of hay stacked per adult man, which is the proper measure of efficiency, is shown for the different methods in Table I.

TABLE I.—Tons stacked per adult man per day, stacking by hand vs. stacker.

Crew.	Method.	Tons stacked per adult man per day.
No. 1...	Wagon loaded and unloaded by hand (3 men).....	2.93
No. 2...	Hay brought to stack with push rake, pitched on to stack by hand (4 men).....	3.12
No. 3...	Wagon loaded with hay loader, unloaded by hand (3 men).....	3.26
No. 4...	Wagon loaded by hand, unloaded with stacker (3 men).....	4.12
No. 5...	Wagon loaded with hay loader, unloaded with stacker (2 men, 1 boy).....	5.87

The efficiency of hay stackers adapted to unloading wagons, i. e., cable, derrick, and tripod stackers, is shown by crews Nos. 4 and 5. The use of the stacker and hay loader (crew No. 5) offers a striking example of improvement over old methods of stacking. Even better results than this are obtained when push rakes are used, in connection with the overshot, swing-around, or combination stacker, all of which are made especially to be used with the push rake.

SIZE OF CREW AND DISTRIBUTION OF LABOR.¹

The distribution of labor is given in Table II, showing the size of crew and kind of work done by each member of the crew, for 11 crews, ranging in size from a small 2-man crew to a large 10-man crew, together with the amount of work accomplished in stacking hay, cured in large cocks, when the yield is 1 ton per acre. Crews such as these are used in the Middle West and West. Some of the crews, as for instance Nos. 5 and 8, will not be used under certain conditions when the yield is 1 ton per acre or more. In each of these crews it has been assumed, for the sake of comparison, that a push rake will handle $12\frac{1}{2}$ tons of cocked hay per day, since this is the average amount handled on a number of farms on which practice with the push rake has been studied. In actual practice, however, the amount handled per push rake will vary both ways from this amount.²

TABLE II.—*Distribution of labor in 11 stacking crews.*

Crew.	Men.	Boys.	Horses.	Tons stacked per day.	Men on stack.	Push rakes used.	Man hours per ton.	Team hours per ton.	Tons stacked per man per day.
No. 1.....	2	1	4	12.5	1	1	2.00	1.60	6.25
No. 2.....	3	1	6	25.0	1	2	1.40	1.20	8.33
No. 3.....	4	1	6	25.0	2	2	1.80	1.20	6.25
No. 4.....	5	1	8	37.5	2	3	1.46	1.06	7.50
No. 5.....	6	1	10	50.0	2	4	1.30	1.00	8.33
No. 6.....	6	1	8	37.5	3	3	1.73	1.06	6.25
No. 7.....	7	1	10	50.0	3	4	1.50	1.00	7.14
No. 8.....	8	1	12	62.5	3	5	1.36	.96	7.81
No. 9.....	8	1	10	50.0	4	4	1.70	1.00	6.25
No. 10.....	9	1	12	62.5	4	5	1.52	.96	6.94
No. 11.....	10	1	14	75.0	4	6	1.40	.933	7.50

In stacking hay with push rake and stacker, if not enough men are used on the stack they will be overworked and the push rakes will be idle a part of the time, while if too many are used the push rakes will not be able to keep them busy. In either case labor will be wasted.

The smallest possible crew for this method is composed of one man on the stack, a boy to drive the stacker team, and one man with push rake. This crew will put $12\frac{1}{2}$ tons in the stack a day (see crew No. 1, Table II), which is at the rate of $6\frac{1}{4}$ tons per adult man per day. This is not a very economical small crew, but it handles hay faster than a 3-man crew can, following any of the above-mentioned methods in which hand labor is used.

On many farms in the Middle West one man on the stack will handle the hay brought by two push rakes, which is at the rate of 8.33 tons per adult man per day (see crew No. 2, Table II).

¹ See United States Department of Agriculture Bulletin 578, A Study of Haymaking Crews and Labor Costs, for full discussion.

² Complete information on the use of the push rake is published in Farmers' Bulletin 838, United States Department of Agriculture, Harvesting Hay with the Push Rake.

It is seldom that one man stacking is able to keep up with three push rakes. This can be done, however, if the stacker is experienced, or if the yield is light, say one-half ton to the acre, and the push rakes bring the hay to the stack at regular intervals so as to give the stacker time enough to stack the hay properly. Beginners in the use of the stacker, especially if the labor obtainable is not of the best quality, will probably get the most satisfactory results by using more men on the stack than are indicated in Table II, at least until the men become accustomed to the work.

When four push rakes are used, and the yield is 1 ton per acre or better, it is customary to use three men and sometimes four on the stack. When four to seven push rakes are used, it will be necessary to use four men on the stack, as the stacker is kept fairly busy bringing up the hay to the stack, and this necessitates a man for each corner of the stack.

It is seldom that more than six or seven push rakes are used. In order to use this number efficiently the stacker should be mounted on wheels so that it can be moved quickly, since it may be necessary to move it once or twice a day. When a new stack is started, some of the push rakes should begin to bring in hay from distant parts of the field, while others work nearer the stack; thus they will be able to keep the hay coming in steadily. This number of push rakes is too large to be used except on farms where hay is grown on a large scale.

A crew using three or four push rakes will be found about the right size for farms growing from 100 to 200 acres of hay.

In some instances it will be found necessary to have one or more extra men in addition to those who are engaged in operating push rakes, or working on the stack. With some types the stacker requires the services of a man to operate it. Again, when several push rakes are used, especially by "green" men or teams, it will be necessary to use one man to clean up the hay dropped by the push rake in unloading around the front of the stacker. The amount that each additional or extra man adds to the total man hours required for stacking a ton of hay, in each of the 11 crews in Table II, is shown in Table III.

TABLE III.—Effect of one extra man on amount of labor required for stacking.

Crew.	Man hours per ton to be added to total man hours in Table II.	Crew.	Man hours per ton to be added to total man hours in Table II.
No. 1.....	0.800	No. 7.....	0.200
No. 2.....	.400	No. 8.....	.160
No. 3.....	.400	No. 9.....	.200
No. 4.....	.266	No. 10.....	.160
No. 5.....	.266	No. 11.....	.133
No. 6.....	.266		

When an extra man is added to a small crew, the labor requirements per ton stacked are greatly increased, whereas the addition of a man to a large crew adds little to the labor required per ton. If an extra man is added to crew No. 1, Table II, composed of 2 men and a boy, he adds eight-tenths of a man hour to the amount of labor required to stack a ton of hay. When an extra man is added to crew No. 11, Table II, composed of 10 men and 1 boy, he adds only a little over one-eighth of a man hour per ton.

When several push rakes are used and they are working fast, more or less hay will be left in front of the stacker. Keeping this hay cleaned up is a very light job, which can be done by a boy. Where there is a boss or overseer, as in the South, this work may be done by him, as he must be on the job all the time anyway, and will thus be where he can direct push rake drivers and keep the hay coming in steadily.

SIZE OF STACK.

The amount of hay put into the stack has an important bearing upon the efficiency of the crew. The size of stack depends upon type of stacker used, yield, number of men working on the stack, and amount of hay brought to the stack per hour. It is scarcely economical to build anything smaller than a 10-ton stack when using a stacker.

STACKS MADE WITH CABLE STACKER.

To move and set up a cable stacking outfit requires considerable time, and fairly large stacks ordinarily should be made in order to prevent a loss of time by the crew while waiting for the stacker to be moved. The ordinary cable stacker is capable of making ricks up to 40 feet in length, although longer ricks can be made when an extra long cable is used. The width of the rick varies from 12 to 20 feet, and the height from 20 to 30 feet. The contents of the stacks may be anywhere from 10 to 30 tons or more. When the amount of hay stacked per hour or per day is known, the size of the stack may be regulated so that it will be finished about noontime or by evening. If this is done the crew will lose little time, since the stacker can be taken down and moved in the morning, while the crew is waiting for the dew to dry off, or at noon, or even late in the evening after the day's work is done.

STACKS MADE WITH DERRICK STACKERS.

The size of stacks made by the different types of derrick stackers varies considerably. Small stackers of this type are often too low to permit the building of tall stacks, but some of the larger stackers used in the West build stacks higher than the cable stacker. Ricks made by derrick stackers are, in general, not as long as those made by

the cable stacker, because of the large amount of labor required in moving the hay to the ends of the rick. Long ricks sometimes are made by making a rick of moderate length, say 30 feet, and then moving the stacker so that the next stack can be joined to the first one. This practice is not to be recommended, unless it is necessary to move the hay to a high point to avoid injury by overflow water, or to place the hay where it will be handy for feeding, as is done in the West by cattle or sheep feeders.

STACKS MADE WITH TRIPOD STACKER.

The tripod stacker usually is not adapted to making long, high stacks, and very often is used by small crews. This stacker, as well as the cable and derrick types, is generally used for stacking hay that is hauled to the stack on wagons. The tripod stacker is easier to move than the cable stacker, or than the derrick that requires the use of gny wires, and for this reason it is generally used for building comparatively small stacks.

STACKS MADE WITH THE OVERSHOT AND SWING-AROUND STACKERS.

The overshot stacker is perhaps better adapted to building stacks of different sizes than any other type. It is much more popular with the average hay grower. It can be used with a small crew or a large one, and, when mounted on wheels, can be moved to a new stack site in a few minutes, with hardly any loss of time on the part of the crew. With this outfit, stacks ranging from 5 to 30 tons or more can be built.

With the swing-around stacker, the same sizes of stacks can be made as with the overshot.

STACKS MADE WITH COMBINATION STACKER.

Ricks of any desired length can be made with the combination stacker without necessitating any extra labor on the stack, because this type of stacker places the hay on any desired part of the stack, and from either side or end. It can be used to build very small stacks as easily as long ricks. The extreme height of stacks made with the combination stacker is from 20 to 23 feet. Many users of this type claim that when it is worked to its capacity, one or two less men are needed on the stack than when stacking with the overshot stacker.

EFFECT OF YIELD ON SIZE OF STACK.

Size of stack is often dependent, more or less, upon the yield of hay, especially when hay is brought to a stack with push rakes, but not when hay is hauled on wagons. Given a fixed number of push rakes, it will be found that larger stacks are, or should be, built when the yield is heavy than when it is light, since building large stacks with a small yield entails a considerable waste of labor.

If the yield is $1\frac{1}{2}$ tons per acre, if three men are working on the stack, and if three push rakes are used, the three push rakes will easily handle 10 tons each per day, making a stack containing 30 tons of the hay from 20 acres. Under conditions just mentioned, all the men in the crew will be kept busy all the time. If the yield of the next cutting (Johnson grass and alfalfa mixed, for example) happens to drop down to half a ton per acre, it will require the hay from 60 acres to make a 30-ton stack. Each push rake will have to cover 20 acres instead of $6\frac{2}{3}$ acres, and, consequently, can not bring the hay to the stack as fast as when the yield was three times as much. To build a stack of the same size will, in this instance, result in less hay being stacked per hour than with the heavier yield, and the stacking crew will be idle a part of the time while waiting for hay to be brought to the stack. Even if more push rakes are added, so as to keep those working at the stack busy all the time, the cost of using the push rakes for such long distances is so great that this plan is never followed by a haymaker who understands his business.

The thing to do in a case like this is to build stacks containing 10 to 15 tons and to move the stacker oftener, rather than to move hay from such a large area to the stacker.

ARRANGEMENT OF CREW AFFECTS SIZE OF STACK.

The length and breadth of the stack that can be built by a given number of men depend upon the amount of hay each man has to handle per hour and also upon whether the hay comes in steadily at fairly regular intervals. If the hay is coming to the stack just fast enough to keep two men busy when building a rick 12 by 20 feet, it would be impossible for them to build a larger rick, for instance, one 18 feet wide and 40 feet long.

No rule can be given for ascertaining the best size of stack to build with a given crew, because many things influence the working of crews. In Kansas and Nebraska, when making alfalfa hay with a yield of 1 ton per acre, one man often stacks the hay brought in by three push rakes. On many farms it is the custom to have one man on the stack for each push rake, up to four men on the stack, which are about as many as can work efficiently. When two men and three push rakes are used, the 15 to 20 ton stack is the size most often built by those who are experienced in haymaking. When three or four men are used on the stack they usually build larger stacks, containing 20 tons or more.

The amount of work done by different men when stacking hay varies widely. Some are very skillful and others do not have the knack of handling hay on the stack. A considerable variation occurs also in the amount of hay a man and team will bring to the stack. Owing to these facts, those using stackers for the first time

can not hope to start right out and build a given-sized stack in a given length of time. After the crew has become accustomed to the work, and to working together, and when everything begins to go smoothly, the hay grower or manager by taking careful note of the increase or decrease in the amount of hay made, can begin to make adjustments until the crew is doing the greatest amount of work possible without overworking either man or horse.

LOCATING STACKS.

Stack sites should be definitely chosen before haying operations begin. The stacker should never be set until the effect the location may have on the efficiency of the crew has been considered carefully. Three points should always be kept in mind when locating stacks, namely, (1) effect of location on total distance traveled in bringing the hay to the stack, (2) lay of the land and its influence on ease of hauling the hay to the stack, and (3) danger of loss of hay in the bottom of the stack due to surface water or ground water.

AVOID LONG HAULS.

Long hauls should be avoided whenever possible, especially when hauling with push rakes. It is very common, on farms where hay is hauled with a wagon and stacked by hand, to see stacks of hay at the end or corner of the field nearest the farm buildings, the site being chosen in order to have the hay handy for feeding.

With push rakes this practice will seriously affect the size and efficiency of the crew. The total distance traveled in bringing hay to one side of a square field is approximately 50 per cent greater than in hauling to the center. If the stack is located at one corner of the field, the total distance traveled is 100 per cent greater. It is necessary to travel about 30 per cent farther in bringing hay to the corner of a square field than to bring it to a side of the field. If four push rakes are kept busy in bringing hay to the center of a square field, six will be required to bring the same amount of hay to the end of the field, and eight to bring the same amount to a stack located in the corner, if it is to be stacked in the same length of time as when stacking in the center of the field.

TAKE ADVANTAGE OF THE LAY OF THE LAND.

To haul hay up hill reduces the amount handled per day, as a well-loaded push rake, especially of the three- or four-wheel type, is usually a load for an ordinary team on level land. In order to have a down-hill haul, it is sometimes a good practice to locate the stack away from the center of the field, thereby decreasing the labor requirement, though increasing the total distance the hay is hauled.

AVOID STACKING IN LOW PLACES.

Stacks should not be located in low or marshy places. Stacks near creek beds are often subject to considerable damage by freshets. To avoid loss of this kind, stacks should always be built on dry, well-drained ground, even though the hay must be hauled a little farther than otherwise would be necessary.

BUILDING THE STACK.**THE STACK BOTTOM.**

To minimize damage by moisture from the ground, care should be taken to keep the hay in the bottom of the stack from coming in contact with the soil. Usually more or less spoiled hay is found in the bottom of a stack that has stood for a considerable time. Such loss may be greatly reduced or altogether avoided by placing old rails, poles, boards, or even straw on the ground so as to keep the bottom of the stack dry.

SETTING THE STACKER.

In setting stackers, the direction of the prevailing wind should be considered. The setting of a cable stacker or a derrick stacker can not be changed easily, because the "dead men" to which the guy wires are attached are usually buried deep in the ground, and to move them requires considerable time. Stackers are usually set to stack with the wind. The combination stacker can be used at either side of the stack, depending on the direction of the wind.

Derrick or pole stackers should be set so that the upright part is perpendicular. The bottom should be level. It is especially necessary that the overshot stacker mounted on wheels be set level, because it will not work to best advantage otherwise and, if much out of level, may be blown over when taking up a full load.

SHAPING THE STACK.

To build a good, symmetrical stack when using a hay stacker requires practice. Hay pitched from a wagon is put on the stack a forkful at a time, which allows plenty of time for the man on the stack to place each forkful and tramp it down. The stacker, however, drops upon the stack larger bunches of hay, which must be quickly spread out or rolled into position without being tramped very much. The weight of the falling hay tends to settle the hay in the middle of the stack, which is a help to those building the stack.

The aim of all good stack builders is to make a stack that will not "take water;" that is, one built so as to shed water away from the center and toward the sides or edges of the stack. This end is accomplished by tramping the middle well and always keeping it higher

than the edges. If this is not done, rain will be directed to the interior of the stack, and serious loss may result.

The shape of the stack has a direct bearing upon the tendency of the stack to take water, and the percentage of hay liable to be damaged. Nine end views representing the ordinary shapes of stacks or ricks are shown in figure 12. Stack No. 1 is perhaps the poorest shape. Stack No. 9 represents a shape in which the loss due to the weather will be least, provided it is built properly. The other seven shapes represent various intermediate types.¹

**PROTECT THE TOP OF
THE STACK.**

The stack should be well topped out and the sides should be raked down with a garden rake or pitchfork to prevent rain from entering the sides. In sections subject to high winds the top should be held in place until the stack is settled.

This is done with weights attached to wire, thrown at intervals across the top of the stack. Old fence posts, tile, or rocks may be used for weights.

Canvas stack covers are used by some good haymakers, practically eliminating loss from rain. A more desirable protection of this kind consists of sheets of corrugated galvanized iron roofing, which can be bought properly curved for this purpose. These are easy to put on, will keep all the rain off the stack, and will last for years. (Fig. 13.)

TEMPORARY OR EMERGENCY STACKS.

Mixed alfalfa and Johnson grass hay is sometimes put in temporary or emergency stacks during unfavorable weather. Such hay is ordinarily cured in large cocks, standing thus until ready to be baled. Continued rainy weather will sometimes wet the hay so that

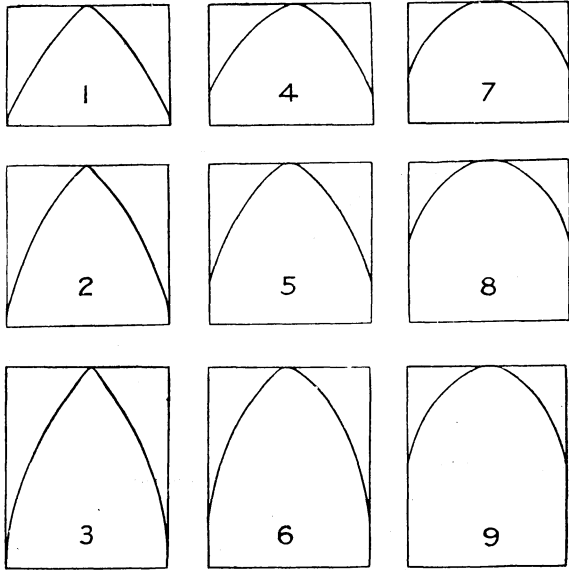


FIG. 12.—End views of different kinds of hay stacks or ricks. The loss of hay due to damage by sun and rain will be greatest in shape No. 1, and least in shape No. 9.

¹Methods of measuring the quantity of hay in a rick are given in Circular 67, Office of the Secretary, United States Department of Agriculture.



FIG. 13.—Corrugated roofing used to protect hay stacks. The strips are held in place by concrete weights. Covering of this type will last for years and will keep rain from entering the top of the stack.

it begins to heat badly. It then becomes necessary to open the cocks and spread out the hay to dry. If there are indications of more rain by the time the hay is dry, it is put into temporary stacks in order to protect it, since if it is recocked the rain will make it necessary again to open the cocks and spread out the hay. Making temporary stacks is rush work, and every available man is used. The hay is usually hauled to the stack with push rakes and pitched on the stack by hand.

An overshot stacker would greatly facilitate emergency stacking on account of the rain, but the use of hay caps would eliminate such work altogether.

Temporary stacks are often baled within a day or two after they are made and before the hay has gone through the "sweat."

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